Special Techniques, Part F: Predator and Pest Management

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A pest is any unwanted organism that directly interferes with human activity (Miller 1988). Insect pests can transmit diseases to captive cranes (Carpenter et al. 1987). Mammal and bird pests consume and contaminate food and can also transmit diseases and parasites (Carpenter and Derrickson 1987). Plant pests may injure cranes, cause illness, or hamper normal husbandry practices. The University of Maryland (1986-87) publication on pest management is a primary source for this chapter, and references to it have been abbreviated UM.

Depredation by birds and mammals accounted for the loss of 51% of 456 wild Sandhill Crane nests in Oregon (Littlefield 1976). Hartman (1987) reported that both raptors and mammals kill captive cranes. Eggs and chicks are, of course, the most vulnerable.

An effective predator and pest management program should: (1) minimize the negative impacts of predators and pests; (2) provide for the safety of personnel, captive cranes, and the environment; (3) operate in accordance with appropriate laws and regulations; and (4) provide training to personnel involved in predator and pest management.

Laws and Regulations

In the United States, the Environmental Protection Agency (EPA) regulates pesticides. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), enacted in 1947 and amended in 1972 and 1978, has established requirements for the registration, manufacture, transportation, and use of pesticides (UM; Miller 1988). State and local governments regulate predator control unless the target species is migratory, threatened, or endangered. In these cases, the following federal regulations must also be met: the Code of Federal Regulations Title 50 (50 C.F.R.) Parts 10 and 21 (Migratory Bird Treaty Act), Part 22 (Eagle Protection Act), and Parts 17 and 23 (Endangered Species Act) (Millsap 1987). A person operating a predator or pest management program must comply with all local and federal laws and regulations, and often must be certified. Contact local or state governments to determine applicable regulations. Failure to comply could result in a fine and/or imprisonment (UM).

Training and Safety

At least one employee in a crane husbandry program should be trained and certified in predator and pest management. Once certified, a person can often train other personnel.

The most important safety rule is to follow pesticide labels and instructions for operating equipment. Material safety data sheets (MSDS) should be obtained from the manufacturer and retained. Because many pesticides can be absorbed through the skin, inhaled, swallowed, or enter the body through the eyes and ears, use protective clothing and equipment and follow proper cleanup procedures to reduce exposure (UM). Protective clothing and equipment should be washed after every use. Pesticide contaminated clothing should be laundered separately from other clothing (University of Maryland 1984). Persons routinely using pesticides should have regular medical checkups and should inform their physician so he can watch for symptoms of overexposure and check medications for adverse interactions with pesticides (UM).

Integrated Pest Management (IPM)

The IPM approach involves many tactics to keep predators and pests below acceptable levels while minimizing harmful effects to the environment (UM; Miller 1988). Each program should include (1) cultural control, (2) sanitation, (3) mechanical and physical control, and (4) chemical control.

Cultural control includes planting, harvesting, and tillage practices that are unfavorable to predators and pests (UM). For example, mowing regularly reduces undesirable woody vegetation in and around crane pens and facilities, and planting densely branched shade trees, such as the Bradford pear (*Pyrus calleryana*), discourages raptors from perching (Fig. 11F.1).

Sanitation reduces food, water, or shelter for pests (UM). Keep food preparation and food storage areas free of spilled food. Providing cranes with the proper amount of food reduces spillage, and removal of spilled food helps prevent disease (Larue 1981; Carpenter and Derrickson 1981, 1987; Carpenter 1986).

Mechanical and physical control devices separate cranes from predators and pests. Electric fences (Fig. 11F.2) exclude mammals (Putnam and Archibald 1987), and spikes or pointed wires on top of utility poles or other likely raptor perches discourage avian predation. Trapping and removal should be employed when other methods have failed.

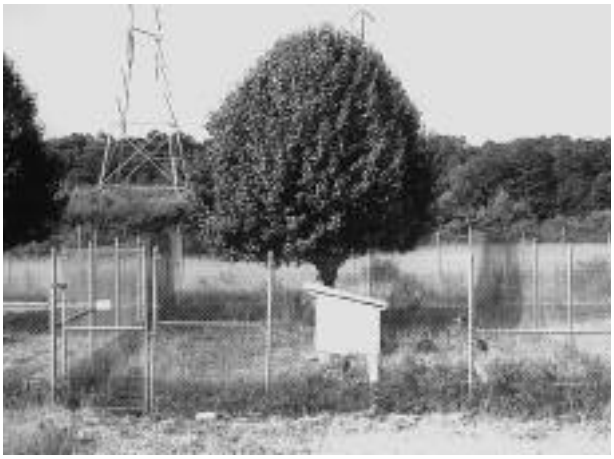

Fig. 11F.1. *The densely branched Bradford pear tree provides shade but does not provide good perches for raptors.*
Photo Jonathan P. Male

Chemical control agents kill, repel, attract, sterilize, or otherwise interfere with the normal behavior of predators or pests (UM). These include pesticides, herbicides, avicides, and frightening agents. Choose the agent that is least disruptive to the crane colony and to the environment and least toxic to the pest's natural enemies.

Fig. 11F.2. *Electric fence and solar charge units.*
Photo David H. Ellis

Specific Management Techniques

Mammalian Predators

Mortality of captive cranes has been caused by raccoons (*Procyon lotor*) (Hartman 1987; Doughty 1989) and probably foxes (*Vulpes* sp. or *Urocyon* sp.) (Carpenter and Derrickson 1981). Feral cats (*Felis catus*) and dogs (*Canis familiaris*), opossums (*Didelphis marsupialis*), and mustelids (Mustelidae) are also potential crane predators. Even rodents (Rodentia) may prey upon crane eggs. At Patuxent, rats (*Rattus* sp.) were once (1966-68) an important mortality factor for eggs (B. I. Williams, Patuxent, personal communication).

Physical barriers (e.g., fences) limit access and prevent losses to mammalian predators. Burying the perimeter fence and extending the wire fabric outward in the trench (Fig. 11F.3) discourages mammalian predators from digging under fences (see Chapter 12; Putnam and Archibald 1987). Archibald and Viess (1979) recommend burying fencing 0.3 m (1 ft) in gravel. Nylon flight netting (Fig. 12.8) discourages avian and to a degree mammalian predators, but both Hartman (1987) and Doughty (1989) reported that raccoons killed cranes despite flight netting. Electric fencing (Figs. 11F.2 and 11F.3) also discourages mammalian predators (see Chapter 12; Putnam and Archibald 1987). We recommend a single, electrical bottom wire (0.5 m [1½ ft] above ground level on brackets holding it 6 cm from the fence) and double

electrical top wires (at least 2 m above ground level and on brackets holding the inner wire 6 cm from the fence and the outer wire 10 cm from the fence). Wire mesh (2.5 cm, 1 in) should extend into the ground and extend above the ground at least to the height of the lower electrical wire. Fence lines and netting should be checked weekly, and the electric current should be tested daily.

Even when outside the pen, mammalian predators can also cause crane injuries or mortality. When frightened, cranes collide with fences or other obstacles. To avoid this problem, crane holding facilities should be surrounded by a perimeter fence (see Chapter 12) providing a "buffer zone" 10 m wide or wider. Visual barriers (e.g., tennis netting, Fig. 12.12) attached to a perimeter fence or the pen wall also help reduce disturbance.

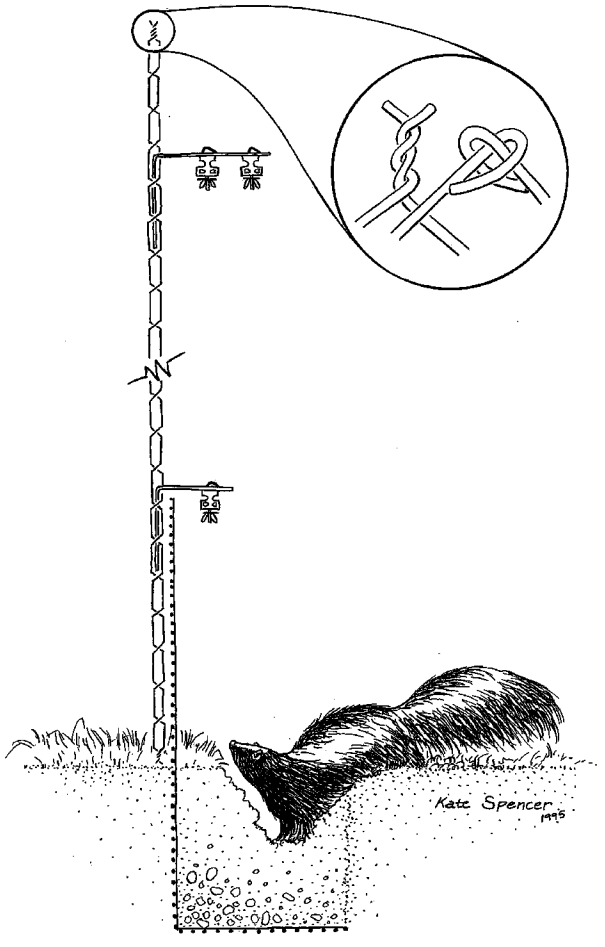

Fig. 11F.3. *Crane breeding pen showing predator exclusion modifications. Inset shows two types of chain link ends. Barbed ends are used only on perimeter fences. Knuckled ends are used on crane pens. Knuckles at the base protect chicks. Those at the top facilitate net attachment or, if the pen is unnetted, prevent injuries if cranes contact the fence top in high winds. Many configurations are possible for electrical wires. In extreme cases, alternate electrical and ground wires for up to 30 cm from the fence.* Art Kate Spencer

Problem predators can be trapped and translocated, or killed. We recommend using live traps when practical; humane treatment should be provided regardless of which removal technique is used. Trapping success will be greatest when the trap is brought to the animal rather than trying to lure the animal to a new location.

Live traps (Fig. 11F.4) are effective for raccoons, skunks (Mustelidae), opossums, and domestic dogs and cats (Boggess et al. 1990). At Patuxent, we have used Tomahawk Model 108 for raccoons and opossums and model 110A, B, or C for medium-sized canids (see Appendix). Manufacturers can suggest the best trap for specific needs. These traps must be baited. Canned sardines or cat food attract raccoons and opossums while meat baits work well for canids.

A variety of commercial steel traps are available to capture animals (Day et al. 1980). Conibear traps (Fig. 11F.4) (see Appendix) are effective over burrows and where predators are travelling through narrow corridors, while foot-hold traps (Fig. 11F.4) are more effective on raccoons (Boggess et al. 1990). Hawthorne (1980) recommends No. 1-1½ foot-hold traps for raccoons. Day et al. (1980) states that No. 1 and No. 2 steel traps are effective on foxes, and No. 3 and No. 4 steel traps are effective on larger canids. Henderson (1985) recommends using two Victor No. 3N coyote traps per set for coyotes (*Canis latrans*). Foot-hold traps with offset and padded jaws are used to capture carnivores more humanely (Day et al. 1980). Red wolves (*Canis rufus*) are captured with Woodstream

Fig. 11F.4. *Three kinds of traps: live (top), Conibear (left), and foot-hold (right; note padded, rubber jaws).*
Photo Thomas E. Lewis

"Soft Catch" No. 3 traps (see Appendix) without serious harm to the animals (personal observation).

The most popular ways to set foot-hold traps are scent posts, dirt holes, and trail sets. Scent post sets use a natural scent such as urine or feces as an attractant. Dirt hole sets use a pungent meat-based attractant in a hole that is 15-25 cm behind the trap. Sets should be placed so that prevailing winds carry the odor across the path of the predator. Trail sets are placed along travel routes where natural features funnel predator movements. All sets should be placed on level ground when possible.

Carefully bury foot-hold traps 1 cm below the surface and chain them to a drag or stake. Place a canvas, plastic, cloth, wire mesh, or wax paper cover over the bait pan and under the jaws, then sift dry fine soil over the trap, chain, and drag or stake. The sets should be camouflaged to blend into the surrounding area. Traps must be checked daily and be set only in areas inaccessible to cranes.

Mammalian Pests

Carpenter and Derrickson (1987) report rodents spreading disease and parasites between areas. Rodents can also consume feed, contaminate feed with their feces and urine, and damage facilities by gnawing and burrowing. Raccoons, opossums, skunks, and marmots (*Marmota* sp.) can consume large quantities of crane feed in a relatively short time. When marmots dig under fences, they provide access for other mammals. Cranes and caretakers can also be injured in marmot burrows.

Fumigants are effective toxicants against burrowing mammals. At Patuxent, we use Giant Destroyer cartridges (see Appendix) with active ingredients of sodium nitrate (46.2%), sulfur (34.8%), and charcoal (8.7%). Place the cartridges directly into the burrow and cover all openings with soil. Filling the holes also eliminates the possibility of cranes succumbing to the fumigant or injuring themselves in the burrow.

For excluding small rodents, crane feed sheds at Patuxent have metal shields (Fig. 11F.5) above the feeder. Good sanitation in feed storage and feeding areas also reduces rodent activity.

Rodenticides are also effective in controlling rodents. Most are stomach poisons. Unless you use two or more different baits in rotation, rodents may develop resistance to or learn to avoid the baits. Many modern baits pose a very low risk of secondary poisoning. For example, Quintox (see Appendix), with the active ingredient cholecalciferol poses low risk to non-target animals. Place these baits in tamperproof boxes (Fig. 11F.6) that facilitate use by rodents but exclude non-target animals. Place bait stations along walls and in known rodent runways, but far enough from pens so that cranes cannot reach them and within perimeter fences so contact with children is unlikely. At Patuxent, we place a bait station in front of every second occupied crane pen (i.e., at ca 60 m intervals). Bait stations should be checked weekly. Bait consumption rates indicate the level of infestation.

Fig. 11F.5. *An overhead rodent shield protects the crane food.* Photo Jonathan P. Male

Problem rodents can be captured individually in live traps. At Patuxent, we bait marmots into a large live trap using apple slices.

Avian Predators

Raptors, both diurnal and nocturnal, may kill adult cranes or chicks. Great-horned Owls (*Bubo virginianus*) have killed captive cranes (Archibald and Viess 1979; Hartman 1987). At Patuxent, Great-horned Owls have killed both adult and juvenile cranes. In addition, crows (*Corvus* sp.) at Patuxent have harassed incubating cranes until the cranes left their nest long enough for the crows to break or steal the eggs (B. I. Williams, Patuxent, personal communication).

Fig. 11F.6. *Rodent bait stations.* Photo Jonathan P. Male

In the United States, the capture, possession, or transport of raptors for depredation control requires a depredation permit (Millsap 1987). The most effective technique to reduce avian predation is to use netted pens (Fig. 12.8). Another effective method is to release target species (such as the domestic Pekin duck, *Anas platyrhynchos*) and allow them to roam free in the colony. When a duck is killed, the carcass is thereafter used to trap the raptor.

Several methods are available to capture raptorial birds while preventing injury to the raptor. Padded foot-hold traps have been useful for owls and eagles elsewhere (Bloom 1987) and at Patuxent. Padded foot-hold traps are most effective when at least four traps are placed around a bait. Use 60-cm chains to attach each trap to a wooden drag (ca 50 cm x 10 cm x 10 cm). The drag prevents escape and absorbs the shock as the bird attempts to flee. Partially cover the traps and chains with soil, grass, leaves, etc. Too much debris over the trap will reduce holding efficiency.

After a raptor kills a crane, it will often return on subsequent days to feed on the carcass. For example, at Patuxent, one Great-horned Owl returned to the same carcass on three consecutive nights allowing us to capture it. Raptors can either be baited to the kill site with the carcass of the crane they killed or another large bird carcass can be substituted. The trap site can also be somewhat removed from the kill site if the pen is still occupied by cranes.

A verbail trap (Bloom 1987) or padded foot-hold trap (Fig. 11F.7) set atop a nearby pole is effective alone or in conjunction with traps around a carcass. If necessary, a temporary perch pole can be installed near the kill to support the trap. The verbail consists of one large (10-cm diameter or larger) nylon noose and trigger mounted atop a post. A spring closes the noose around the bird's leg or legs when it lands on the trigger. The spring is tied to the perch with a nylon line that allows the bird to flutter safely to the ground.

Once a bird is captured, it should be examined for injuries, and then released at least 20 km away from the trap site. At Patuxent, we commonly transport owls at least 100 km from the kill site.

Fig. 11F.7. *Padded foot-hold pole trap (note jaw with rubber to protect the legs of a bird).*
Photo Jonathan P. Male

Avian Pests

Avian and mammalian pests pose similar problems. Wild birds, especially other cranes, should be excluded from a crane colony to avoid introducing parasites and diseases (Carpenter and Derrickson 1987). Flocks of small birds sometimes consume large quantities of feed and contaminate food with feces. Other pest birds, such as House Sparrows (*Passer domesticus*), may nest in crane shelter areas and could thereby create parasite and disease problems.

Alternatives to killing pest birds are available. Although flight netting (Fig. 12.8; mesh size 5.1 cm [2 in]) will discourage predators, many species of small birds can pass through this barrier. Providing food indoors can reduce the attraction to certain pest bird species. A pest guard (Fig. 11F.8) has been designed and tested at Patuxent to protect crane feeders. It

Fig. 11F.8. *Pest guard on crane feeder at right allows the crane's bill to pass, but excludes even very small pest birds and mammals. Normally feeders are suspended 0.5 m from the ground.*
Photo David H. Ellis

consists of parallel bars 11 mm apart. This design allows the bill of the crane access to food but excludes small birds and mammals. To discourage House Sparrows, remove their nests, and, when possible, cover the opening to the nest site with 1.2 cm (0.5 in) wire hardware cloth to prevent reentry and subsequent nesting attempts. If the nest sites cannot be covered, nests should be removed bi-weekly.

If pest birds cannot be excluded from crane holding facilities, trapping and chemical control may be necessary. Although Starlings (*Sturnus vulgaris*), House Sparrows, and feral Pigeons (*Columba livia*) do not have protection under federal law in some countries, they may have local protection (MDA 1984). Native birds may also be affected by trapping procedures so federal and local permits are required. The U.S. Fish and Wildlife Service (1977), Hawthorne (1980), and Bub (1991) discuss methods of trapping pest birds. Mist nets can be used (Day et al. 1980), but birds must then be released far (at least 10 km) from the crane colony.

When trapping is ineffective, toxic or aversive chemicals may be required. Employ caution to avoid contact with the cranes. Avitrol (see Appendix) is a frightening agent with an active ingredient of 4-aminopyridine. When ingested, it causes the bird to emit distress cries while flying erratically. This behavior frightens the rest of the flock. The product is relatively safe, affects only 1% of the target species, and has no secondary hazards (Hawthorne 1980). Avitrol is registered for control of feral Pigeons, gulls (*Larus* sp.), House Sparrows, Starlings, and blackbirds (Icterinae).

Starlicide Complete (DRC-1339, 3-chloro-4-methylbenzenamine HCl; see Appendix) is a chemical toxin used to control birds. At Patuxent, we control Starlings, crows, and Grackles (*Quiscalus* sp.) with Starlicide in crane feeders in unoccupied pens. During extreme infestations, we briefly (no longer than 8 hours) remove the feeders from occupied pens during application so that the offending birds will concentrate on the Starlicide. After use, contaminated feeders are thoroughly cleaned. Any spilled Starlicide must be removed before cranes are introduced into these pens. Cranes that have accidentally ingested Starlicide pellets at Patuxent have been treated with activated charcoal and have recovered with no permanent effects (G. F. Gee, Patuxent, personal communication). Starlicide is highly toxic to most pest birds, but less toxic to predatory birds and mammals (DeCino et al. 1966; Schafer 1981).

Avicides can be placed on elevated boxes (25-30 cm) in the area where pest birds are feeding or, during periods of snow cover, placed on a plastic sheet on the snow. Cover avicides overnight to prevent them from becoming wet from dew or precipitation or from being eaten by non-target species. Unused avicide should be destroyed by incineration or, if in good condition, placed back in the original container.

Reptilian Predators and Pests

To reduce the threat large snakes may pose to chicks, use one of the two types of snake proofing discussed by Hawthorne (1980): (1) a 0.64 cm (0.25 in) heavy galvanized mesh screen 90 cm wide which is buried a few cm in the ground and slanted 30 degrees outward from bottom to top, or (2) a 10 to 15 cm wide and 5 cm deep strip of concrete around the perimeter with an electric wire 12 cm above the concrete. Mowing close to the ground eliminates food and cover for reptiles. Moats may be used, and reptile traps are also available (Day et al. 1980).

Arthropod Pests

Problems from arthropods include: (1) ectoparasites, (2) irritations or mortality caused by insect bites and stings, and (3) mortality caused by insect-borne diseases. In 1984, the eastern equine encephalitis virus killed 7 of 39 Whooping Cranes at Patuxent (Derrickson 1985; Carpenter et al. 1987). The principle vector was the mosquito *Culiseta melanura*. Other arthropod-borne diseases are listed in Chapter 8. Some of these (e.g., Lyme disease) also threaten caretakers.

Spot application of insecticides or repellents is the most common method of insect control. Bees (Apidae) and wasps (Vespidae) in crane holding facilities must be controlled to avoid potentially dangerous stings to cranes and caretakers. At Patuxent, small chicks have developed swollen areas from suspected stings. When wasp nests are found, spray them immediately. Wasp spray (Wasp Freeze; see Appendix), when applied to the corners of feed sheds and other shelters, appears to repel for about 30 days. Insect attacks are also dangerous to humans especially when operating machinery. To avoid injury, destroy ground nests by first flagging them upon discovery, and then spraying them during the evening or early morning when the insects are inactive.

When flies (Order Diptera) threaten chicks or injured birds, bait with attractants and fly paper (but keep these out of reach of cranes), or treat afflicted birds with insect repellent. Fire ants (*Solenopsis* sp.) threaten ground nesting birds in some areas (Vinson and Sorenson 1986). If ants are a problem, seek help from governmental agencies and private exterminators that control insects. Many tick-borne (Ixodidae) diseases threaten humans and wildlife (Davidson and Nettles 1988). Personnel should wear repellent, tuck pant legs into socks, and examine themselves for ticks after each visit to infested areas. Permanone (active ingredient 0.5% Permethrin; see Appendix) repels ticks, but should only be applied to clothing. Regular pen mowing also reduces contact with ticks.

Plant Pests

Pest plants can cause illness and injury to cranes, damage facilities, and interfere with normal husbandry practices. In general, cranes do not eat noxious plants; however, if a problem is suspected, obtain information through local agricultural extension agents. Plants with thorns or sharp projections can cut or puncture cranes (especially chicks) and cause secondary infections.

Except for shade trees, grasses should predominate in outdoor crane holding facilities. Vines and woody vegetation can cause injuries to cranes, damage fences and facilities, interfere with the proper functioning of electric fences, interfere with mowing, and damage equipment. Large plants can also hamper visual inspection of cranes and facilities.

Mowing reduces woody vegetation and makes conditions less suitable for hosts of diseases (Carpenter and Derrickson 1987). To reduce disturbance to the cranes, vegetation control can be coordinated around the pen rotation schedule (see Chapter 2). At Patuxent, we mow empty pens first, then move birds into the empty pens, and then mow the formerly occupied pens. At Patuxent, we mow about three times each season. The pens in the breeding colonies are not mowed until egg production is completed and there are no chicks under 30 days of age in the immediate area. We mow these pens again in late summer, 5-8 weeks after the first mowing.

A plant-free zone should extend 0.25 m from each side of perimeter fences and can be maintained with non-selective herbicides like Roundup (N-phosphonomethyl-glycine 41%; see Appendix). An additional 1 m strip on either side of perimeter fence should be mowed to keep the vegetation short. A vegetation-free area around water sources is maintained by placing a 10 cm deep bed of gravel on top of a 1 m diameter sheet of plastic (Fig. 12.13). The interior of feed sheds can be kept vegetation free with a 10 cm deep layer of sand that also facilitates removal of spilled food (Fig. 11F.9). Using non-selective herbicides and renewing gravel or sand beds when needed will maintain these areas vegetation free but should be coordinated with mowing to reduce disturbance. Avoid using herbicides where they are accessible to cranes.

Combine various methods of vegetation control to maximize their effectiveness. For example, if mowing is scheduled a few days after herbicide use, regrowth is reduced (i.e., weakened by the herbicides).

If pest plant problems arise during the breeding season, postpone control measures unless there is an immediate threat to the cranes. For example, it may be advisable to remove thistles from a pen with a small chick.

Fig. 11F.9. *Sand floor in the feed shed facilitates removal of spilled food and other debris.* Photo Jonathan P. Male

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